Control of oral cancer in developing countries*

A WHO MEETING[1]

Oral cancer is one of the 10 most common cancers in the world. In Bangladesh, India, Pakistan, and Sri Lanka it is the most common and accounts for about a third of all cancers. More than 100 000 new cases occur every year in south and south-east Asia, with poor prospects of survival.

The importance of oral cancer as a public health priority is underscored by the fact that the suffering, disfigurement, and death it causes need not occur. The commonest cause of oral cancer—tobacco use—is well known and can be eliminated. For the oral cancer cases that do occur, detection at an early stage is possible, allowing simple inexpensive treatment, and resulting in long-term survival.

Enough is already known about the disease and its prevention for action to be taken. With firm commitment, correct priorities, and concerted efforts by governments and individuals, strategies can be designed, programmes can be implemented, and the disease can be prevented. The economic saving in health care costs to a country, by itself, justifies these steps; the prevention of suffering and death of oral cancer victims makes them mandatory.

This article reviews the current knowledge about the epidemiology, etiology, pathology, prevention, and treatment of oral cancer. It describes a strategy for controlling the disease, sets priorities, and recommends actions that governments and individuals can take. Finally, it identifies targets for future research.

EPIDEMIOLOGY AND ETIOLOGY

The incidence rate of oral cancer, which includes cancer of the oral cavity (ICD 141–145) and cancer of the vermilion border of the lip (ICD 140), varies widely from one country to another, and from region to region within countries. The highest rates are reached among the peoples of south and south-east Asia (e.g., in Bangladesh, Burma, Democratic Kampuchea, India, Malaysia, Nepal, Pakistan, Singapore, Sri Lanka, Thailand, and Viet

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[1] A full list of participants in the meeting is given on page 829.

Nam) where the habit of chewing tobacco is common. The incidence is also high in some other areas in the world, such as parts of Brazil, Canada, France, and the USSR. Data on the incidence rates of oral cancer from two Asian countries, and for contrast from two developed countries, are summarized in Table 1. Accurate data are not yet available for Bangladesh, Burma, Democratic Kampuchea, Nepal, Pakistan, and Viet Nam, where the incidence is known to be high.

There is excellent evidence from many sources that, in developing countries, the chewing of tobacco is by far the most important cause of oral cancer. The most common form of tobacco chewing is the

Table 1. Incidence of oral cancer in selected areas[a]

	Males	Females
Bombay, India	16.7[b]	10.6[b]
Pune, India	18.6	7.4
Singapore (Indian population)	14.2	8.6
New York State (excluding New York City), USA	8.6	3.4
German Democratic Republic	5.0	1.5

[a] Data are taken from *Cancer incidence in five continents, Vol. IV (18)*. Registries selected are the three from south-east Asia and the two largest registries from the developed countries appearing in the above-mentioned reference.

[b] Figures are average, annual, age-adjusted incidence rates per 100 000 population.

betel quid, which usually consists of the leaf of the betel vine (*Piper betle*), areca nut, lime and tobacco. The composition and method of use of quids and other forms of tobacco use vary from region to region. In India, flakes of sun-dried tobacco are usually mixed with powdered or sliced dried betel nut and slaked (stone or shell) lime, the whole being wrapped in a betel leaf on which catechu, an aqueous extract of the heartwood of the *Acacia catechu* or *Acacia suma*, has been smeared. Spices such as cardamom, cloves, or aniseed may be incorporated for additional flavour. In Thailand, turmeric is usually added. The slaked lime may be prepared from the shells of snails in Sri Lanka and India (Kerala), and coral is sometimes used for this purpose in the Pacific Islands. In Malaysia (Borneo) and Singapore the catechu is exhibited in a different form as gambier. In Papua New Guinea the areca nut is first chewed, slaked lime is then applied repeatedly to the buccal mucosa, and then the stem of the betel bush is chewed. In Indonesia the nut is chewed together with the lime and betel leaf. The teeth are then cleaned with finely cut tobacco, which is also placed close to the labial commissure, protruding out of the mouth. The tobacco is saved and can be reused several times.

Other forms of tobacco use are also potent causes of oral cancer. These include the use of *nass* or *nasswar*,[a] the smoking of *bidi*,[b] and reverse smoking, in which the smoker turns a cheroot around and keeps the lit end inside the mouth.

The evidence about the carcinogenic effect of tobacco use is clear cut. Not only is there a high correlation between tobacco-chewing habits and the incidence of oral cancer in different regions, but also the results from numerous prospective and case-controlled studies in areas where tobacco chewing is popular indicate that (1) virtually every case of oral cancer occurs in persons who use tobacco, and (2) people who chew tobacco have a greatly elevated risk of developing oral cancer. The case against tobacco is further strengthened by the findings that the cancers almost always occur on the side of the mouth where the tobacco quid was kept, and the probability of developing cancer is directly correlated with the duration and intensity of such use.

The relative risk of oral cancer in people with various tobacco habits, as well as the frequency of those habits, is summarized in Table 2, based on retrospective case-controlled studies in India and Sri Lanka by Hirayama (*11*). There is a wide variation in the frequencies and risks in different regions, but certain conclusions stand out. Approxi-

[a] *Nass* is a mixture of tobacco, ash and lime with oil or water. It is inserted into the mouth cavity in small amounts (1–3 g) and after some minutes is spat out.

[b] *Bidi* is a type of cheap cigarette. It is made by rolling a rectangular, dried piece of temburni leaf (*Diospyros melanoxylon*) with 0.1–0.3 g of tobacco and securing the roll with a string.

Table 2. Risks of oral cancer from various tobacco habits[a]

Habits	Frequency in men (%)	Relative risk[b]	Percentage of oral cancer cases attributable to various habits
None	20–50	1	—
Betel quid only	3–5	1–4	1
Smoking only	5–30	3–6	8
Betel quid incorporating tobacco	5–25	8–15	30
Betel quid and smoking	10	4–25	2
Betel quid incorporating tobacco and smoking	10–25	20	50
Total			91

[a] Computed from data of Hirayama (11).

[b] Compared to people who have no chewing or smoking habit; different rates are from different studies in India and Sri Lanka.

mately 90% of oral cancers in south and south-east Asia can be attributed to tobacco chewing and smoking habits. The highest risks occur in people who use tobacco by incorporating it in the betel quid and also by smoking. In these people the risk of developing oral cancer is about 10–20 times greater than in people who neither chew nor smoke tobacco, giving them a lifetime risk of developing the disease in the order of 10%. The risk is also increased by increasing use of tobacco and is higher for people who begin chewing tobacco at an early age, who chew tobacco for a long time, who chew betel quids frequently and continually, or who keep a quid in the mouth overnight.

There is some evidence that the risk of oral cancer is increased in people who chew quids even without tobacco, compared with people who do not chew quids at all. While the relative risk associated with each item used in the quid (e.g., betel leaves, areca nuts, and lime) has not been established, the risk of oral cancer in those who chew with tobacco is considerably higher (e.g., by a factor of about 10) than if tobacco was not included in the quid (9).

Data from certain parts of the developed world indicate that oral cancer can also be caused by high concentrations of alcohol, and alcohol appears to have a synergistic effect on the risk of oral cancer in tobacco users. Other factors, such as poor diet and nutrition, immunological disorders, infection with human (alpha) herpesvirus 1, Candida infection, chronic sores from jagged teeth and dentures, and poor oral hygiene may also increase the risk of oral cancer, but the available data are not conclusive. In practical terms, the importance of these factors as a cause of oral cancer is very much overshadowed by tobacco.

The participants at the meeting considered the many forms of tobacco use and the many different types of cancer that tobacco can cause, and agreed that the use of tobacco is by far the most important avoidable cause of cancer known. Not only is the smoking of manufactured cigarettes responsible for one third of cancers in many developed countries (6), but also the chewing and smoking of tobacco in south and south-east Asian countries is responsible for about a third of the cancers that occur in those areas.

PATHOLOGY AND NATURAL HISTORY

A vast majority, in most reports more than 90%, of the tobacco-associated oral malignant tumours are squamous cell carcinomas (17). Some reports indicate that

verrucous carcinoma may occur more frequently in south and south-east Asia, most likely because of the extensive habit of chewing tobacco.

Oral cancer is preceded in almost all cases by precancerous lesions (leukoplakia and erythroplakia), and occasionally by other conditions (submucous fibrosis, lichen planus, syphilis). Leukoplakia is a clinical term for a white patch or plaque that cannot be characterized clinically or pathologically as any other disease. The term does not carry any histological connotation. Leukoplakias can be classified into homogeneous and non-homogeneous, the latter group comprising verrucous, nodular, and erythroleukoplakic types (*3*). The prevalence of precancerous lesions varies widely; in India the range is 0.2–5.0% (*8*, *14*).

Homogeneous leukoplakia is characterized by a uniform white lesion with a smooth or corrugated surface. Histologically it most often is hyperorthokeratotic; less frequently it is hyperparakeratotic. Dysplastic changes are seen in only two to five per cent. The verrucous type is characterized by a warty surface. Nodular leukoplakia shows white nodules on an erythematous background. Erythroleukoplakia (speckled leukoplakia) is characterized by a mixture of white and red areas. Both the nodular and the erythroleukoplakic types are usually associated with epithelial dysplasia and a *Candida* infection (*2*, *10*), and these two types together with the verrucous type show the highest rate of transformation to malignancy. The annual rate of malignant transformation in leukoplakia varies from 0.13% to 6% in different reports (*16*).

Among the precancerous conditions (i.e., a generalized state associated with a significantly increased risk of cancer), submucous fibrosis is of greatest interest in the Asian countries. Clinically it is characterized by the appearance of fibrous bands of the oral mucosa. Histologically, there is a marked atrophy of the epithelium, possibly making the epithelium more vulnerable to the action of carcinogens.

Although no definite morphological, histochemical or immunological criteria have yet been demonstrated to identify the particular types of leukoplakia that will eventually undergo malignant transformation, in general the higher the degree of dysplasia, the greater the chances of eventual malignancy. Also, in general, dysplastic lesions are about 15 times more likely to result in malignant transformation than are nondysplastic lesions. While the precise time from the initial development of a precancerous lesion to its malignant transformation is not known and varies from lesion to lesion, it is measured in years and has been observed to take up to 15 years.

PRIMARY PREVENTION

Primary prevention activities are designed to reduce the occurrence of cancer and precancerous lesions, thereby reducing the morbidity and mortality of invasive cancer.

In the case of oral cancer, primary prevention focuses upon modifying habits associated with the use of tobacco. There are three major ways to modify these habits and hence prevent oral cancer:

(1) Encourage people never to adopt any tobacco habit.

(2) Encourage people who already use tobacco to stop.

(3) Encourage people who already use tobacco and cannot stop to at least decrease their use or to modify behaviour in other ways to reduce the risk of cancer.

There is excellent evidence that the risk of oral cancer is dramatically lower in people who never adopt any tobacco habit; this evidence is judged strong enough to justify, and indeed to compel, the implementation of carefully planned programmes to decrease the adoption of tobacco-using habits.

Table 3. Changes in tobacco habits in three places in India following a five-year prospective intervention study[a]

Tobacco habit	Srikakulam (Andhra Pradesh)	Ernakulam (Kerala)	Bhavnagar (Gujarat)
Completely stopped	17%	9%	13%
Reduced frequency by 50% or more	49%	28%	20%
No change	34%	63%	67%
Total	100%	100%	100%
No. of tobacco users: in baseline survey	12 043	12 213	12 221
in fifth follow-up	10 254	10 588	9 824

[a] From Gupta et al. (see footnote c on this page).

It has been shown (Table 3) that primary prevention programmes can significantly reduce the tobacco habits in India, and the regression rate of leukoplakia was higher among those who stopped or reduced their tobacco consumption (15).[c] There is good evidence from the natural history of oral cancer that (1) depending on the person's age, the type of precancerous lesion, and other factors, a sizeable proportion of cases of leukoplakia will progress to invasive cancer if the tobacco habit continues and that (2) in most, if not all cases, oral cancer is preceded by a precancerous lesion. Additional evidence that addiction to tobacco can be decreased is available from studies of cigarette smoking and lung cancer in developed countries, where comprehensive education and legislative programmes have significantly reduced the population rates of cigarette consumption (4).

Programmes aimed at the primary prevention of oral cancer have only recently been started and detailed information on their long-term effect, specifically the reduction of oral cancer mortality, is hence unavailable. However, the available evidence about the natural history of the disease, coupled with evidence of the effectiveness of tobacco-reduction programmes on precancerous lesions, strongly suggests that programmes to decrease or stop the use of tobacco in current users will reduce the morbidity and mortality of oral cancer.

Because the smoking of *bidis* is associated with increased risks of pulmonary disorders in addition to pharyngeal, laryngeal, esophageal, lung and oral cancer, and because the mortality of *bidi* smokers is increased compared with those who do not smoke (7), this form of tobacco habit should also be controlled.

Detailed epidemiological information on the modification of risk in people who discontinue the tobacco habit in Asian countries is currently not available; however, evidence from studies of cigarette smoking and lung cancer suggests that the risk of lung cancer in tobacco users who stop the habit is decreased and, over a period of 10–15 years, the risk may approach that of people who never used tobacco (5).

Epidemiological studies have shown that individuals who sleep with the quid in their mouth, or who use quids frequently or for extended periods, are at especially high risk for oral cancer. Even if an individual were unwilling to break the habit completely, reduction of the habit may have a beneficial effect. However, cessation of the tobacco habit is by far the preferred goal, and reduction of the habit should only be considered if all attempts to break the habit have failed.

[c] GUPTA, P. C. ET AL. A prospective intervention study for primary prevention of oral cancer among 36 000 tobacco users. (Submitted for publication).

The consensus of the participants at the meeting was that this evidence, although indirect, is strong enough to justify implementation of planned primary prevention programmes to help current tobacco users to decrease or eliminate their tobacco habits. It would be inappropriate to delay the implementation of well-planned programmes on the grounds that further large-scale studies are needed to test the impact of primary prevention activities on oral cancer morbidity and mortality. Because tobacco use is a learned, shared, and habit-forming behaviour that has a significant social and economic impact, the problems of changing tobacco-related habits are great and careful programme planning is required.

National prevention programmes

National primary prevention programmes should begin by informing government officials and key public figures about the seriousness of the problem and by informing the public about the health risks. The next step should be the formulation of a planning and action centre as the focal point for tobacco control activities. This centre should be responsible for collecting information for planning and programme implementation; providing information to key individuals, groups and the general public; developing education materials for use by various groups; and coordinating and monitoring the programme. Programme activities should be tailored according to the local economic, political, cultural and health care situation.

There are two aspects to a primary prevention programme: legislation and health education.

The availability of tobacco and extent of the habit in the population can be affected by legislative efforts to restrict the production, importation, sale and use of the product, to create an awareness of the health hazards, to increase the price of tobacco products, and to modify the product.

Legislation should be enacted to:

(*a*) prohibit the sale or handing over to minors of tobacco products for chewing or smoking (including *bidi*);

(*b*) place health warning signs wherever tobacco products for chewing or smoking are sold, and place health warning signs on packets containing these products;

(*c*) prohibit advertising of tobacco products;

(*d*) restrict smoking of tobacco products in enclosed public places (e.g., hospitals, theatres, restaurants, and places of business);

(*e*) increase the taxes on tobacco products, including *bidi*;

(*f*) regulate the content of tobacco products to decrease tars, nicotine and other carcinogenic agents.

While the difficulties in modifying long-standing habits and the difficulties of controlling what is in part a cottage industry are formidable, all possible intervention points for control must be identified because of the magnitude of the problem and the value of prevention.

Public information and health education programmes should have the following objectives:

(1) to encourage individuals, especially schoolchildren, not to adopt any tobacco habits in the first place;

(2) to encourage individuals who use tobacco to stop;

(3) to encourage individuals who use tobacco and cannot stop to at least decrease their use;

(4) to encourage individuals to rinse their mouths after chewing tobacco, especially prior to retiring;

(5) to encourage people not to retain the quid in the mouth during sleep;

(6) to encourage public support for the introduction of effective legislation;

(7) to encourage public support for adequate enforcement of legislation, once it exists.

A health education programme should combine various techniques, such as person-to-person communication, person-to-group communication, and the mass media. Use could be made of television, films, radio, newspapers, magazines, posters, folk dramas, and health warning messages on tobacco products and at points of sale. There are many different targets of an education programme, including the general public, decision-makers, leading public figures, medical and paramedical personnel, schoolchildren and high-risk individuals, and specific objectives should be designed for each target group.

Education in the prevention of oral cancer should be an integral part of the work of health personnel at all levels, especially those who have extensive contact with the community. When allied health workers are used for conducting oral cancer educational programmes, their training must be carefully planned and their performance adequately supervised and evaluated periodically.

The above prevention measures should begin as soon as possible and should be initiated and supported by a wide variety of governmental and nongovernmental actions. Such actions in the context of tobacco smoking control programmes are described in the report of the WHO Expert Committee on Smoking Control Strategies in Developing Countries (20).

EARLY DETECTION

The purpose of early detection is to identify cases with precancerous lesions and cancers in the early stages when treatment is more effective. At present in developing countries, more than 50% of oral cancers are detected only after they have reached an advanced stage. Cancers in these stages are disfiguring and painful, the treatment required is both extensive and expensive, and survival rates are low, with less than one tenth of the patients surviving even five years.

The natural history and anatomical site of oral cancers, however, provide excellent opportunities for early detection. The great majority of these cancers are preceded by precancerous lesions such as leukoplakia, and these lesions can be detected for up to 15 years prior to their change to an invasive cancer. Furthermore, it is easy to examine the oral cavity and to recognize a potential cancer lesion. Organized efforts at early detection should result in the detection of most lesions before they have started to spread and the detection of the remainder in the very early stages.

A screening programme in Sri Lanka has demonstrated that primary health care workers under field conditions can examine large numbers of people, and can detect and classify precancers and cancers of the oral region with acceptable accuracy (19). While no randomized controlled trials have been conducted to demonstrate a reduction in mortality as a result of early detection, the participants at the meeting agreed that existing information concerning the natural history and treatment of the disease, together with preliminary evidence from field trials of early detection, pointed to this.

Efforts at early detection can take many forms. The simplest way is to educate and encourage individuals to examine their own mouths. At a second level, health care workers can routinely examine the mouths of patients who visit for other reasons. Third, organizations and governments can sponsor larger-scale efforts to seek out and examine groups of the populations at risk. When the latter type of programme is undertaken, efficiency and effectiveness of the early detection effort can be increased by focusing on high-risk individuals (e.g., people over 30 years of age, tobacco chewers, or *bidi* smokers),

and by providing coordinated services for diagnosing and treating any lesions found. The value of early detection efforts is also increased when they are combined with education programmes to reduce the use of tobacco.

The Meeting made the following recommendations.

1. Primary health care workers should be trained to search for oral precancerous lesions and cancers when they see high-risk individuals.

2. Education about oral precancer and cancer should be strengthened among dentists and physicians at both the undergraduate and postgraduate levels.

3. Public education programmes should be developed to encourage and instruct people to perform oral self-examination and to examine each other.

4. A warning sign for oral cancer—"A persistent white or red patch in the mouth"—should be added to the existing list of seven warning signs of cancer (1).

Community-oriented early detection programmes can be initiated not only to detect precancerous lesions and early stage cancers, but also to increase public awareness and knowledge of oral cancer. When such programmes are undertaken, they should be coordinated with programmes for diagnosing and treating any lesions found, and for educating the public about self-examination, and the need to eliminate the use of tobacco. Such programmes should also be monitored until sufficient experience is gained to ensure their effectiveness.

DIAGNOSIS

Diagnosis of oral cancer and precancerous lesions is relatively simple. Digital examination is essential to assess the extent of the disease, and clinical examination of the pharynx and hypopharynx should also be carried out. Every lesion should be staged and classified to determine the modality and extent of treatment required, using the TNM classification of the UICC (International Union against Cancer) or AJC (American Joint Committee) (12, 13). A definite diagnosis can be made by histopathological examination of a biopsy. The minimum tests also include radiography of the lesion and the chest (if there are signs or symptoms of involvement), a complete blood picture, and urinalysis.

TREATMENT

Precancerous lesions

Homogeneous leukoplakias can usually be cured by cessation of tobacco use. In addition, antifungal treatment should be instituted for non-homogeneous leukoplakias with epithelial dysplasia, if infection with *Candida* is present. If such lesions do not respond to this treatment, they should be surgically removed. The infrequent erythroplakic lesions with epithelial dysplasia but without *Candida* should be removed surgically. When patients cannot stop their tobacco habit, they should be examined at yearly or more frequent intervals. Patients with submucous fibrosis should be kept under observation and advised strongly to give up the tobacco habit.

Cancer

The main treatment modalities that offer hope of cure are surgery and radiotherapy. Chemotherapy, which is currently used for advanced or recurrent cancers, is not curative.

High cure rates can be achieved in stage I (T_1N_0) and early stage II (T_2N_0) cases by

surgery or radiotherapy alone. T_1N_0 lesions have five-year survival rates exceeding 75% and T_2N_0 lesions have a five-year survival rate of approximately 60%.

Patients with advanced disease, stages III ($T_3N_{1,2}$) and IV ($T_4N_{1,2,3}$ or M_1), fare poorly with any treatment, and the five-year survival rates drop to about 10%. However, for certain cancers of the buccal mucosa (i.e., verrucous carcinoma), even if the primary tumour is very large, lymph node metastases are infrequent, and surgery may be curative. Prophylactic neck dissection is usually not advised in T_1 lesions. However, morphologically anaplastic T_2 infiltrative tumours in the anterior tongue should be considered for a prophylactic neck dissection, particularly if the possibility of follow-up is poor.

Radiotherapy can be as effective as surgery for early stage disease. This modality may involve less morbidity and give cosmetically a more acceptable result. Good results are obtained with a basic telecobalt unit with adequate source target distance (80 cm) and an individualized collimating system. For implantation ^{137}Cs or ^{192}Ir can be used. No significant improvement in response is observed by superfractionation, radiosensitizers, neutrons, hyperthermia or adjuvant combination chemotherapy. Also, high-energy machines such as linear accelerators or betatrons do not offer any distinct advantage.

Combined treatment modalities consisting of surgery and pre- or postoperative irradiation are sometimes tried in advanced lesions. However, five-year survival rates do not improve much and even palliation is infrequently achieved. The combined modality is, therefore, not recommended as a routine procedure. Combination chemotherapy as an inducting adjunct prior to surgery or radiotherapy is now being increasingly employed. However, at present, this approach is under investigation and is not recommended as routine treatment.

There is often a wide variation in the quality of therapy available in different parts of a country. When this is the case, steps should be taken to raise the quality of therapy in the deprived areas to as uniform a standard as possible throughout the country.

Regional centres should be established to serve as a resource for training personnel to provide appropriate oral cancer diagnosis and treatment.

Supportive services

Supportive measures can have an important impact on the effectiveness of therapy. For example, maintenance of nutrition — orally or by tube feeding — can improve the response to any form of therapy. Attention to oral hygiene and dental care is especially important to prevent osteoradionecrosis. Appropriate use of vitamins, proteins, antibiotics, and mouthwashes will help prevent infection.

REHABILITATION

The objective of rehabilitation is to restore the patient to as normal a state of health and vocational ability as possible. Rehabilitation should be an integral part of management, the patient being informed of the management plan prior to the initiation of any treatment.

The extent of rehabilitation that will be needed is directly proportional to the extent of surgical excision. Minimum rehabilitation is required for patients treated with irradiation and with limited local excision. Patients with advanced oral cancer, however, may require extensive orofacial excision and reconstruction. These procedures may not only result in cosmetic deformities but also in varying degrees of interference with speech, swallowing and respiration; they should be carried out only at specialized cancer centres. The rehabilitation team should consist of speech and occupational therapists, physiotherapists, a medicosocial worker, a maxillofacial prosthodontist, and a psychiatrist.

The relief of pain is an important part of rehabilitation in inoperable and very advanced cases.

PRIORITIES FOR ORAL CANCER CONTROL

There are many different ways to control oral cancer, spanning the spectrum from primary prevention, through early detection, to treatment and after-care. Within these general categories there are a large number of options. Each of the many possible control measures can be expected to have different effects on the incidence, morbidity, and mortality of oral cancer, and to require different amounts and types of resources. Ideally, it would be desirable to implement all the programmes that might be effective in controlling this disease. However, there are usually severe limitations on the available resources, and priorities must be set. Highest priority must be placed on those programmes that promise the greatest impact for the amount of resources needed.

To help set priorities for oral cancer control programmes, the participants at the meeting adopted a technique that estimates the expected benefits and costs of different programmes, and that ranks programmes according to the expected reduction in incidence, morbidity and mortality achievable with fixed resources.[d] The technique incorporates the existing information about the incidence, risk factors, mortality, stage and treatment of oral cancers in developing countries. It estimates the reduction in number of cases and number of deaths from oral cancer that would result from different control programmes, as well as the cost and resources (e.g., manpower, educational materials, training and facilities) that would be required. The evaluation of specific programmes takes into account additional factors such as the proportion of people who can be expected to participate in a prevention programme, the success rate for getting people to change their behaviour, compliance rates to diagnostic and therapeutic interventions, dropout rates, the effect of behavioural changes on the incidence of precancerous and cancerous lesions, the effectiveness of different types of therapy, and the values of different types of outcomes.

Six types of programmes were considered:

1. Programmes to educate schoolchildren against tobacco use, with the aim of preventing them from adopting any tobacco habits.

2. Education programmes for current tobacco users to induce them to stop or decrease their use of tobacco.

3. Community-level early detection programmes by primary health care workers to detect precancerous lesions, and to educate those with such lesions against tobacco use.

4. Continuation of current treatment programmes with no new initiatives.

5. Use of chemotherapy for late stage disease.

6. Improvement of the quality of treatment to match standards achieved in the developed countries ("sophisticated treatment").

These six programmes were evaluated for the expected effect on incidence and mortality, as well as costs, in a typical population of 100 000 in a developing country such as India or Sri Lanka. Ranking of these programmes is shown in Table 4, each score being roughly proportional to the number of lives among oral cancer patients that would be saved each year if the programme were implemented, compared with a zero score for the present treatment situation, the total budget for oral cancer treatment and control remaining constant. The scores take into account different types of outcome, such as prevention of cancer cases and improved survival of patients with cancer.

While there is uncertainty about many aspects of oral cancer control programmes and

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[d] EDDY, D. Setting priorities for cancer control. (Unpublished manuscript, Duke University, Durham, NC.)

the results may vary in different countries, the participants at the meeting agreed that the results of this analysis permitted the following conclusions.

1. Primary prevention, the helping of people not to use tobacco in the first place and helping current users to stop, holds tremendous promise as an effective and efficient way to decrease the incidence, morbidity and mortality of oral cancer.

2. Education programmes for school-children about the health effects of tobacco use can be expected to save more money than the cost of these programmes because prevention of cases will lead to a reduction of future treatment costs. This approach is many times more efficient, compared with the treatment of patients after they get oral cancer, in terms of reducing morbidity and mortality in a population.

Table 4. Setting priorities for oral cancer control programmes, based on a scoring system[a]

Control programme	Score
1. Education of schoolchildren	67
2. Early detection	15
3. Education of tobacco users to stop or decrease tobacco use	11
4. Treatment as available now	0
5. Chemotherapy	-2
6. "Sophisticated therapy"	-4

[a] The score of a programme is roughly proportional to the number of oral cancer patients whose lives would be saved (or lost, in the case of negative numbers) each year, compared with a zero score for continuation of the present treatment standards (i.e., no new programmes). The calculations assume that (1) the programme is introduced in a population of 100 000 people, (2) the programme has been in place long enough for maximum impact to have occurred, and (3) there is a constant budget.

3. Education programmes to help current tobacco users to stop or decrease their use also appear to be more cost-effective than current treatment programmes in their ability to reduce oral cancer morbidity and mortality in a population. The costs of such education programmes will more than likely be offset by reduced treatment costs.

4. Community-based early detection programmes coupled with treatment can also be expected to be more efficient than current treatment programmes alone, with approximately the same impact as education programmes for current tobacco users, a fixed budget being assumed.

5. While chemotherapy may help a few patients, it is expensive. If the intention of an oral cancer control programme is to decrease the incidence, morbidity, and mortality of oral cancer, the resources for chemotherapy can be put to much better use in primary prevention.

6. Attempts to raise the level of oral cancer therapy to the standards in developed countries may be counterproductive at the present time. The cost of such programmes would be extremely high, and any resources put into this effort would be at the expense of other oral cancer control programmes including the provision of basic care and services to the community outside the reach of the major medical centres. The net result could be a serious increase in morbidity and mortality from oral cancer. While it may be appropriate to attempt to bring a common standard of therapy to all regions in a developing country, efforts to imitate the standards in developed countries should be given low priority.

The participants urged that, in the future, the planning of oral cancer control activities should use techniques like those described above to organize existing information about this cancer, to estimate the outcomes of proposed control programmes, to set priorities, and to identify research needs.

RECOMMENDATIONS FOR RESEARCH

General

In order to enable the comparison of research results, the clinical and pathological definitions, data collection, outcome measures, and statistical and evaluation methods

should be standardized. For many research questions, the best approach is to combine the resources and conduct multicentre studies. International collaboration, wherever possible, is highly desirable.

Epidemiology and etiology

Studies should be carried out on the prevalence and relative risks of different forms of quid and tobacco habits. In countries where information on tobacco habits in relation to oral cancer is not available, such studies are recommended.

Pathology

A study of the natural history of precancerous lesions and conditions should be conducted, with special reference to:

(*a*) the clinicopathological characteristics that determine the malignant potential of leukoplakia;
(*b*) the role of infection with *Candida* in malignant transformation of leukoplakia;
(*c*) the clinical and pathological behaviour of submucous fibrosis;
(*d*) the time of transformation from benign to malignant.

Primary prevention

Studies are recommended on the following:

(*a*) the effect of programmes to stop adolescents from acquiring tobacco habits;
(*b*) the effect of education in inducing current tobacco users to stop or decrease their habit;
(*c*) the effect of decreasing or eliminating the use of tobacco on the incidence of new precancerous lesions and on the regression of existing precancerous lesions;
(*d*) the effectiveness of different methods for implementing primary prevention programmes in local settings.

Early detection

The following research is recommended:

(*a*) determination of the design and effectiveness of education and cancer detection programmes to improve the speed with which individuals seek care for precancerous and cancerous oral lesions;
(*b*) study of factors that affect participation rates in early detection programmes and rates of individual compliance with the programme;
(*c*) evaluation of the effectiveness of different methods for implementing early detection programmes in local settings.

Treatment

The management of precancerous lesions and oral cancer could be elucidated by studies of:

(*a*) the efficacy of vitamin A (retinoids) in the treatment of leukoplakia;
(*b*) the efficacy of antifungal drugs on the clinical behaviour of infected leukoplakia;
(*c*) the effect of surgical excision on precancerous lesions.

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LIST OF PARTICIPANTS

M. Al-Sarraf, Division of Oncology, Wayne State University, Detroit, MI, USA

C. Bunyanraavej, National Cancer Institute, Bangkok, Thailand

M. G. Deo (*Rapporteur*), Cancer Research Institute, Tata Memorial Centre, Parel, Bombay, India

P. B. Desai, Tata Memorial Centre, Parel, Bombay, India

D. M. Eddy (*Rapporteur*), Centre for Health Policy Research and Education, Duke University, Durham, NC, USA

C. F. von Essen, Swiss Institute for Nuclear Research, Villigen, Switzerland

P. C. Gupta, Dental Research Section, Tata Institute of Fundamental Research, Bombay, India

T. Hirayama, Epidemiology Division, National Cancer Centre Research Institute, Tokyo, Japan

N. Kolyzsheva, Department of Pathology, Kazakh Research Institute of Oncology and Radiology, Alma Ata, USSR

U. K. Luthra (*Vice-Chairman*), Indian Council of Medical Research, New Delhi, India

C. Mehta, WHO Collaborating Centre for Cancer Biostatistics, Department of Bio-statistics, Harvard School of Public Health, Boston, MA, USA

S. Mitra, Office of the Director-General of Health Services, New Delhi, India

U Myo Tint, Radiotherapy Department, Rangoon General Hospital, Rangoon, Burma

M. K. Nair, Radiotherapy Department, Regional Cancer Centre, Medical College, Trivandrum, India

N. Nazrul Islam, Pathology Department, Institute of Postgraduate Medicine and Research, Dhaka, Bangladesh

J. J. Pindborg (*Chairman*), The Royal Dental College, Copenhagen, Denmark[e]

G. L. Sabherwal, Department of Dental Surgery, Ram Manohar Lohia Hospital, New Delhi, India

S. Sivayoham, Cancer Control Programme, Department of Health, Colombo, Sri Lanka

S. Warnakulasuriya, Dental School, University of Peradeniya, Kandy, Sri Lanka

Zhang Kui-hua, Beijing Hospital, Beijing, People's Republic of China

International Agency for Research on Cancer

C. S. Muir, Descriptive Epidemiology Unit, IARC, Lyon, France

WHO Secretariat

W. Griffiths (Temporary Adviser to Health Education Service, WHO, Geneva) School of Public Health, University of California at Berkeley, Berkeley, CA, USA

K. H. Notaney, WHO Programme Coordinator, Colombo, Sri Lanka

C. H. Piyaratna, Health Education, WHO Regional Office for South-East Asia, New Delhi, India

K. Stanley (*Secretary*), Cancer Unit, Geneva, Switzerland

J. Stjernswärd, Cancer Unit, Geneva, Switzerland

H. Zaman, Noncommunicable Diseases, WHO Regional Office for South-East Asia, New Delhi, India

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[e] Also represented the International Union against Cancer.

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